

SOMATOLOGY, OR THE ESSENTIAL AND CONTINGENT PROPERTIES OF MATTER.

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THE Greek and Roman languages furnish us with many of the terms or words which we employ in scientific discourse. Among these may be classed the word that we have written as the title of this essay; it is a word purely Greek, and signifies a discourse about matter or bodily substance. The Saxon language has furnished the word body which originally signifies stature, and our old writers define it as implying a compound of matter and form, but in their application of the term, they restrict its signification to any substance possessing a definite form, as an animal.

The word *matter*, on the other hand, both anciently and now, comprehends, in common parlance, any thing in which extension predominates, together with a capability of receiving, without any regard being had to external figure, And an epithet, *substance* assimilates all the objects to which it is applied to particular portions of matter presented to our senses, under various appearances and forms.

Hence, the terms *body*, *matter*, *substance*, though usually employed as synonymous, have, in reality, different significations: the first implying figure; the second, gross mass; and the third any thing not aeriform; yet air or gas, or vapour is a substance, and before matter, as much so as a piece of coal or a bronze statue. Thus, a pint of water driven off as steam from the boiler of a low-pressure engine, fills a space capable of holding two thousand pints, and raises the piston through this with a force of many thousand pounds, and immediately afterward re-appears in the cold condenser as a pint of water which is double substance.

But it will suffice for our purpose to observe that the words now under consideration, like a great many others employed in treating upon scientific subjects, are rarely confounded by their use and application. All men speak of bricks, lime, timber, iron, slates, stones, marble, &c., as the materials out of which houses are built. And we talk of the finest pieces of sculpture that represent the figures of men and women, as marble. No one mistakes these marbles for the spheres of baked clay that children play with. So also by the term *materials* we understand rough, misshapen, unaccounted, unconstructed masses; but whatever has order and symmetrical arrangement, that we call *body*; and the noun substance will indicate any thing palpably gross in opposition to such things as are fluid or aeriform; yet we have shewn that water and vapour or the clouds of the sky, have substance as well as the rocky mountains, or the people who through the crowded city.

We are never misunderstood when we say, the wind blows, the rain patters, the river rolls its waters along, the smoke rises, the clock strikes, the engine works, the ship sails; yet all these phrases are as metaphorical as they are literal. Who does not know that the blowing is the wind, else whence the exclamation, "it blows hard?" That the declivity is the rain falling? That the declivity in its channel causes the water in the river to roll? That the air raises the smoke? That the hammer strikes the bell of the clock? That the engine is put in motion by some agent foreign to itself? That the ship is borne along on the bosom of the deep by the wind which fills her sails?

OF BODY, THAT IS, MATTER OR SUBSTANCE.
To illustrate our notion of body, that is to say, of matter, which is something that possesses qualities or properties discernible to our senses, let us take a billiard ball which has figure and colour; and which may be put in motion; but the ball is not figure, nor is it colour, and it is not motion, though it may be made to move. It is none of these individually, and collectively they do not constitute the matter out of which the ball is made. The ball has something that has figure and colour, and that may be put in motion. This is dictated by the nature and belief of all mankind. But the ball is ivory, and ivory is the tooth of an elephant, or the tooth of an elephant is ivory. And what is ivory? Matter; the essence of which is totally unknown to us, but we have the information

of nature for the existence of these properties in matter which our senses enable us to discover, and upon which it is our province to reason and speculate. The essence, like the origin of matter, is impenetrably hid from our view.

"IN THE BEGINNING GOD CREATED THE HEAVEN AND THE EARTH."

Here all our boasted knowledge ends, and here our faith dates its origin. The heaven studded with innumerable stars, each of which we may consider the centre of a system as vast as that to which our earth belongs! And the earth! the habitation of rational, accountable beings, created in the image of God, who has assigned it to man with all that it possesses and all that it can produce. It is, then, with that heaven and with this earth that natural philosophy professes to make us better acquainted, and in proportion as it augments our stock of knowledge, it is calculated to increase our faith in that sublime truth which could only be revealed of old by the Creator and Governor of the Universe, and who alone knoweth the essence of which matter hath been formed.

From an object so familiar to our view as a billiard-ball, let us now turn our attention to the materials composing the earth that we inhabit, and inquire whether they have always existed as we find them, or whether they have undergone changes as wonderful as the ivory ball made out of the tusk of an elephant.

Our earth has undergone vast changes on its surface as well as in its interior mass. If the ocean once stood at the height of fifteen thousand feet above its present level, a fourthly part of the whole earth must have passed from being above the level of the present sea to be under it. And these changes may have produced great variations in the position of the earth's axis, which may have gone through a long series of changes, and may have carried the equator, and the accumulation of waters which accompanied it, over regions from which they are now far distant. Many facts in the natural history of the earth and of its mineral kingdom give countenance to these suppositions; and if it be true that the more ancient strata have been set on edge, and that the continents have been raised up by the action of an expansive force in the interior of the earth, we shall be compelled to admit the existence of numerous agents or laws employed by the Creator of the World in regulating the varied phenomena of matter, as the action of impulse, cohesion, elasticity, chemical affinity, crystallization, heat, light, magnetism, electricity, galvanism, with the existence of a principle more general than any of these, and connecting all of them with that of gravitation.* Let us call that indescribable principle the essence of matter. We are as far from defining what matter actually is, as we are from accounting for Saturn's ring, or the belts that skirt the planet Jupiter. In fact, we know nothing of matter but what concerns its various properties. But we have made prodigious advances upon the scanty knowledge of the ancients, who regarded air, fire, water, and earth as the four primary elements of which all things were composed, and each of which was separate and far from distinct from the others.

But the bones of man, which takes its origin from the vegetable kingdom. We found this conclusion upon experiment. By distillation coal yields a watery phlegm, volatile oil, volatile alkali, and thick oil, which last, on being rectified, produces a thin oil; but it is remarkable that this last, by exposure to the air, becomes black like animal oil. Besides, we find traces of vegetables very abundant in the strata of coal fields. And it is no argument against our theory that many of the vegetables remain found in the coal-strata of Great Britain belong to classes of plants which are now found only to exist in the equatorial regions. Thus, the Grampian Hills had formerly spires waving on their tops, while at their bases the crocodile swam; but at the great and universal deluge, convulsions and dislocations changed the exterior surface of our globe, and deposited its bowels vast forests of antediluvian growth, which have become those great magazines of fuel, so convenient

for the use of man, and in the application of which he finds such ample scope for the exercise of his industry and ingenuity.

Moreover, we convert coal into gas, which is merely an accidental state of existence in which any body may exist, according to the degree of heat which it can imbibe. How much further the ingenuity of man may change the matter we call coal, it is quite impossible to foresee; because in coal, as in all matter, there is the existence of a principle more general than any which chemistry hath yet discovered, namely its essence, and which will for ever prevent it from assimilation. But though we cannot divine this essence or principle of matter, for we may extend it to all bodies, there are some kinds of matter that we can bruise, others we can cut and divide, some we can dissolve, and the appearance of all may be changed in many ways; yet reduce them as we may by divisions, subdivisions, by chemical processes, and by mechanical contrivances, the particles, how minute soever, indestructible atoms, which occupy some space to the exclusion of all other matter from that individual space; and this occupancy of space is the simplest and most complete idea we can have of material existence.†

The most perfect idea we can form of atoms is by viewing the tumultuous motion or agitation of the celestial fluid, which we call air, while the sun is above the horizon. The sky may seem transparent and undisturbed to the naked eye, but a good telescope will shew us what a tumult arises in the atmosphere from the agitation of the sun's beams in the heat of noon-day—not unlike what is raised in the waters of the sea by the impetuosity of the wind. It increases with the altitude of the sun, and when the evening comes on, it subsides almost into a calm.‡ It may be pertinent to our present view of atomic existence to observe that the Hebrew word *day* signifies a root signifying *turning, tumultuous motion*; and from the same root is derived the word *sea*, evidently from its being the submissive patient of winds, tides, currents, and caloric action. But that the reader may not fancy we have pressed this idea into our service, we refer him to Parkhurst's Hebrew Lexicon,§ in which he will find this thought blended in a very masterly style. But that the learned lexicographer introduces the various significations of the Hebrew word *day* to prove the signification that Moses attached to the root, but to give a true and faithful exposition of its various imports as diversified by prefixed particles and terminal adjuncts. Moses writes that "God said, Let there be light, and there was light, and the light he called 'day'." Genesis, ch. i. vv. 3, 4, 5.

Though the ancients made no experiments to ascertain the spirit of the atmosphere to other matter in the universe, the doctrine that Moses, guided by the spirit of inspiration, gives of light being called day, and day signifying in the Hebrew tongue the tumultuous motion of the celestial fluid, plainly informs us that he understood how its two great and constituent ingredients existed as distinct substances. Modern experiments squeeze out the heat, make its particles collapse from their ordinary state, assume the state of a tenuous fluid; which may then be regarded as such for ever, or may be decomposed and rendered solid in combination with other bodies;¶ or it may be again set at liberty as a light, invisible, insupportable fluid, such as mankind breathe, and which envelops the earth all around to the height of many thousand feet. Such is the effect of heat, that flame and smoke are merely hotter air rising in the midst of colder. Plume is seen in the form of gas, or mineral ingredients in combustion combined with the oxygen of the atmosphere. And smoke consists of all the dust and visible particles which are separated from the fuel, without being burned. These minute particles are light enough to be borne aloft in a current of heated air; but all that is visible of smoke is in reality heavier than air, and presently falls again, and the mass of a volcano fall upon the sea, or the surrounding country.

The subject in hand is finely illustrated by viewing the clouds that float along the sides

* Playfair's Outlines of Natural Philosophy, vol. II., p. 361.

† Dr. Buckland's speech at the British Association held at Edinburgh, September 1828.

‡ Aristotle's Elements of Physics, vol. I., p. 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100.

§ Quæstio edition, 1789, pp. 111 and 112.

¶ Aristotle's Physics, v. 1, p. 208.